

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

REC'D 16 DEC 2004

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To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/US2004/027722

International filing date (day/month/year)
25.08.2004

Priority date (day/month/year)
28.08.2003

International Patent Classification (IPC) or both national classification and IPC
H04L25/02

Applicant
QUALCOMM INCORPORATED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2004/027722

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2004/027722

Box No. II Priority

1. ☒ The following document has not been furnished:

☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).

☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. ☐ It has not been possible to consider the validity of the priority claim because a copy of the priority document was not available to the ISA at the time that the search was conducted (Rule 17.1). This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

4. Additional observations, if necessary:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	4-6 9-19 23-25 28-38 42-44 47-57
	No: Claims	1-3 7 8 20-22 26 27 39-41 45 46
Inventive step (IS)	Yes: Claims	4-6 23-25 42-44
	No: Claims	1-3 7-22 26-41 45-57
Industrial applicability (IA)	Yes: Claims	1-57
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Document

- 1.1 The following document is referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1: TENG JOON LIM: "Bias in CDMA channel estimates with the use of short spreading sequences" IEEE 6TH INT. SYMPOSIUM ON SPREAD-SPECTRUM TECH. AND APPLICATIONS, vol. 1, 6 September 2000 (2000-09-06), - 8 September 2000 (2000-09-08) pages 288-291, XP010517569 PISCATAWAY, NJ, USA

2. Novelty and Inventive Step - Article 33(2) PCT - Article 33(3) PCT

- 2.1 The present application does not meet the requirements of Article 33(1) PCT, because the subject-matter of **independent claims 1, 20 and 39** is not new in the sense of Article 33(2) PCT.

Using the terminology of **claim 1** of the present application, **document D1** discloses (the references in parentheses applying to this document):

a method of estimating a communication channel impulse response $h(t)$ (page 289, right column, eq. 13), comprising the steps of:
generating $co_m(t) = co(t + mNT_c)$ for $m=0,1,\dots,M$ by correlating a received signal $r(t)$ with a spreading sequence S_i of length N , wherein the received signal $r(t)$ comprises a chip sequence c_j applied to a communication channel characterizable by an impulse response $h(t)$, and wherein the chip sequence c_j is generated from a data sequence d_i spread by the spreading sequence S_i and wherein T_c is the chip period of the chip sequence c_j (page 288, right col., eq. 4; page 289, left column, eq. 5: the received signal is correlated with the spreading sequence $s_{11}^H(i)$);
generating an estimated communication channel impulse response $h_M(t)$ as a

combination of $co_m(t)$ and d_m for $m=0,1,\dots,M$; (page 288, right column, eq. 4; page 289, left column, eq. 6: correlation results are multiplied by the data sequence $d_1(l)$); and
filtering the first estimated communication channel impulse response $h_M(t)$ to generate the estimated communication channel impulse response $h(t)$ with a filter f selected at least in part according to the spreading sequence S_i (page 289, right column, eq. 13: the channel estimates are decorrelated by filtering with \mathbf{R}_p^{-1} , wherein \mathbf{R}_p is the spreading sequence autocorrelation matrix, as shown in page 289, right column, line 30 and page 289, left column, lines 9-10).

The subject-matter of **claim 1** is therefore not new (Article 33(2) PCT).

- 2.2 The same reasoning applies, mutatis mutandis, to the subject-matter of **claims 20 and 39**.
- 2.3 Dependent **claims 2, 3, 7-19, resp. 21, 22, 26-38, resp. 40, 41, 45-57** do not contain any additional features which, in combination with the features of **claim 1, resp. 20, resp. 39** are new or involve an inventive step.

The subject-matter of **claims 2, resp. 21, resp. 40** is disclosed in **document D1**, page 289, right column, line 30 and page 289, left column, lines 9-10.

The subject-matter of **claims 3, resp. 22, resp. 41** is disclosed in **document D1**, page 289, left column, lines 9-10: \mathbf{R}_p depends on the paths of the code, and therefore implicitly on the duration of the impulse response.

The subject-matter of **claims 7, resp. 26, resp. 45** is disclosed in **document D1**, page 290, right column, line 12: $N=8$.

The subject-matter of **claims 8, resp. 27, resp. 46** is disclosed in **document D1**, page 288, right column, equation 4: only one data symbol is used.

The subject-matter of **claims 9-19, resp. 28-38, resp. 47-57** is not inventive as Walsh codes with corresponding correlation properties are commonly used in DS-CDMA systems.

- 2.4 The combination of the features of dependent **claims 4, resp. 23, resp. 42** is neither known from, nor rendered obvious by, the available prior art.

Claims 4, resp. 23, resp. 42 define a method, resp. an apparatus wherein the filter f is selected according to a zero-forcing criteria, so as to eliminate the effects

of the side lobes of the autocorrelation of the spreading sequence within a predetermined time span, as said side lobes cause significant distortion to the estimate of the communication channel.

- 2.5 **Claims 5-6, resp. 24-25, resp. 43-44** depend on **claims 4, resp. 23, resp. 42** and therefore equally satisfy, as such, the conditions required by PCT in matter of novelty and inventive step.